FIRST CLASS

MONITOR SYSTEMS
an AYDIN company

PHONE 215-646-8100
TWX 510-661-1520

401 COMMERCE DRIVE, FORT WASHINGTON, PENNA. 19034

September 23, 1968

Mr. T. Nelson, Systems Consultant
Box 1546
Poughkeepsie, New York, 12603

Dear Mr. Nelson:

MONITOR Systems, Inc. is pleased to learn of your interest in our Display Systems as reported in the June issue of Datamation. I am enclosing information on our line of display and communication terminal equipments.

MONITOR Systems, Inc. was formed in 1961 and has specialized in the manufacture of communication equipments including Information Displays, Data Conversion Systems, Error Detection Systems, and PCM Telemetry Systems for government and industry.

Please feel free to contact me for any additional information you may require. MONITOR Systems would be pleased to work with you in your communication and display requirements.

Very truly yours,

MONITOR Systems, Inc.

CM Pafort

Christopher M. Pafort
Sales Manager
Computer Communications and
Displays Division

CMP:da

Enclosures

MONITOR SYSTEMS
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MONITOR 8040 CHARACTER AND FORMAT GENERATOR for High-Performance CRT Displays

The MONITOR Model 8040 Character and Format Generator provides high-speed digitally controlled stroke character and format generator for use with direct-writing cathode ray tube display systems. Its Character Generator produces 20-stroke characters in 2 microseconds, offering unusually high performance for applications such as 2000-character flicker-free computer controlled displays. Its Format Generator permits location and annotation of targets such as on radar or map displays, by providing an identifying symbol from which a leader may be drawn to another area of the display where a descriptive array of characters may be projected.

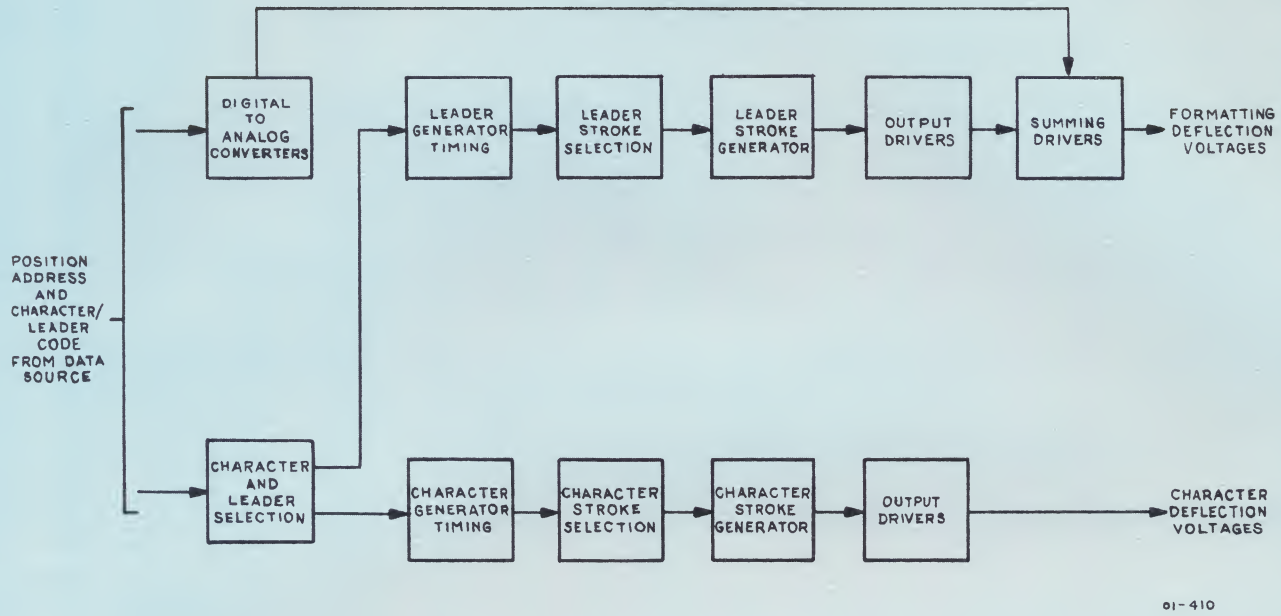
DESIGN FEATURES

- Separate outputs for characters and formatting.
- Up to 20 strokes per character.
- Maximum character writing time: 2 microseconds.
- Average character writing time: 1.3 microseconds.
- Maximum leader writing time: 4 microseconds.
- Leader writing time proportional to leader length.
- Positioning Time: 1 microsecond.
- Repertoire of 64 alphanumeric characters and symbols of adjustable size.
- Repertoire of 32 leaders of 4 different lengths and 8 different directions with adjustable scale.
- Individual character font or leader length and direction programmable by replacement of printed circuit card.
- Positions characters at the end of a leader in response to digital input addressed, either by individual location or with optional typewriter sequencing.

By deletion of the Format Generator, the unit is available as only a high-speed Character Generator.

FUNCTIONAL DESCRIPTION

The input lines accept the character, leader, and position information upon which the generators operate to provide the proper character, leader, and position signals. The block diagram shows the inter-relationship of the various functional elements.



BLOCK DIAGRAM

CHARACTER GENERATOR

The receipt of a write-start signal enables a character clock gate thereby permitting clocked generation of the signals required to generate the character. This timing provides up to 20 sequential signals for the generation of the character strokes. A character is formed automatically by generating a vector stroke signal in each of up to 20 intervals. The standard character repertoire is shown in Figure 1.

Each individual stroke is a vector sum of one or more units in the plus or minus X, plus or minus Y or one-half unit in the plus or minus X directions.

Any of the character stroke functions may be used in any time segment by diode decoding one of the sixty-four arrays of 20 x 7 character matrices. The desired array is selected by one of sixty-four character-select lines.

The outputs of the stroke matrices are strobed to the function generators and an intensity modulator which turns the beam off during retrace or background motions.

Function generators provide accurate voltage levels which are summed and integrated by output driver circuits. These outputs are the complex X and Y deflection voltages necessary for the stroke generation of characters.

A write-complete pulse is provided for asynchronous operation.

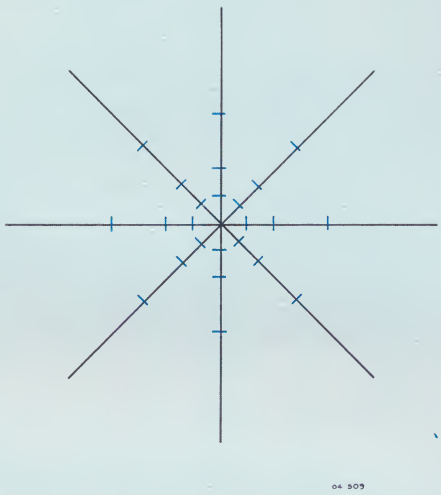
FORMAT GENERATOR

The Format Generator consists of a Leader Generator and a Position Generator.

Leader Generator

The receipt of a write-start signal enables a leader block gate thereby permitting clocked generation of the signals required to generate a leader. A leader is formed automatically by generating a vector sum of X and Y component signals for each leader interval. Leaders available for selection are shown in Figure 2.

This combination of signals includes one unit in each of



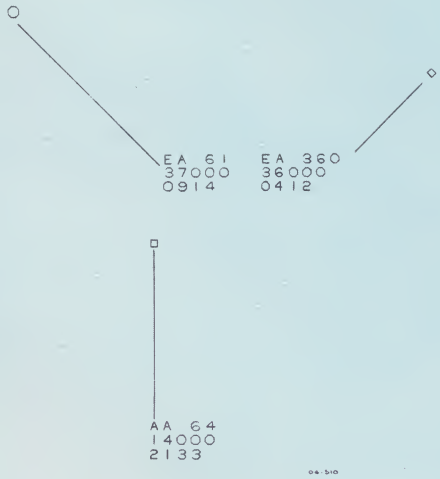


FIGURE 1
CHARACTER REPERTOIRE

FIGURE 2
LEADER REPERTOIRE

FIGURE 3
SAMPLE DISPLAY

the plus or minus X, or plus or minus Y directions.

Leader length is determined by the time allotted to a constant-velocity stroke.

The four available leader time segments are one, one-half, and one-quarter and one-eighth units.

Any of the leader stroke functions may be decoded with any timing segment to generate "ON" or "OFF" axis leaders. The input code is used to select one of 32 possible leaders. These include selection of N, NE, E, SE, S, SW, W, and NW directions, each of which will be 1/8, 1/4, 1/2 or 1 full unit in length. The leader length, as defined for any display, is directly related to the ratio of full scale output voltage representing 1 unit of leader length to the amount of linear CRT beam motion caused by this voltage in a specific display.

The outputs of the leader selection matrices are strobed to function generators. Intensity modulation signals are provided for the blanking of the beginning and ending portions of each leader to permit symbols to be located in the blanked area.

The function generators provide accurate voltage level signals which are summed and integrated by the output driver circuits. These output voltages are the X and Y deflection voltages necessary for leader generation.

Position Generator

Input signal lines accept the character positioning address and strobe it into two digital to analog converters which produce the X and Y positioning voltages. These positioning voltages are summed with the leader deflection voltages and are provided at the output for character positioning at the end of a leader. The leader generator maintains its final position for up to 70 microseconds. The resultant positions generated by the position generator are relative to this end of the leader.

Optionally, automatic sequencing logic is available to provide typewriter-like advance of characters, including the equivalent return and line-feed in response to corresponding input codes;

An example of an annotated radar display is shown in Figure 3.

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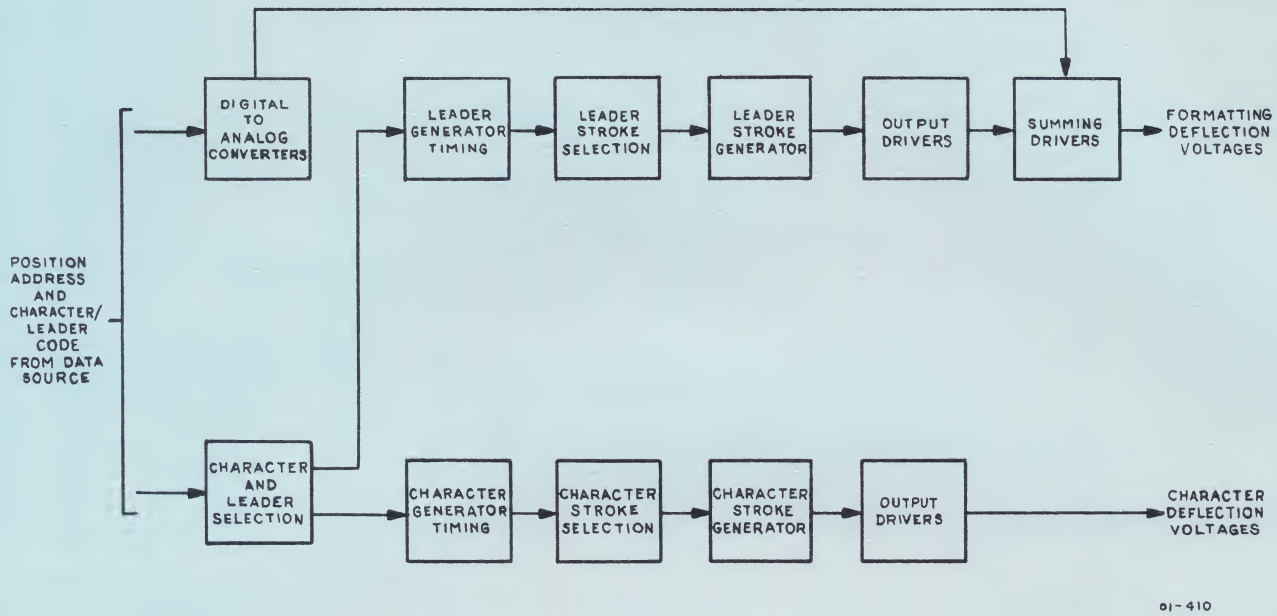

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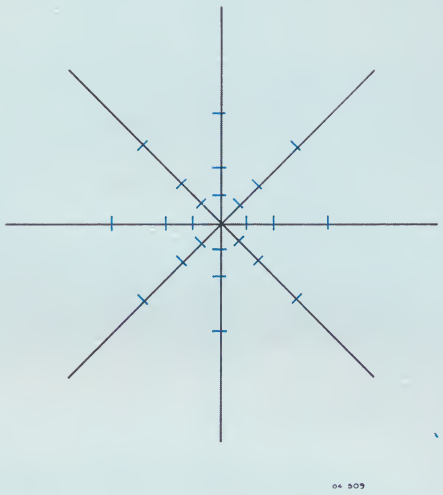

FIGURE 2
LEADER REPERTOIRE

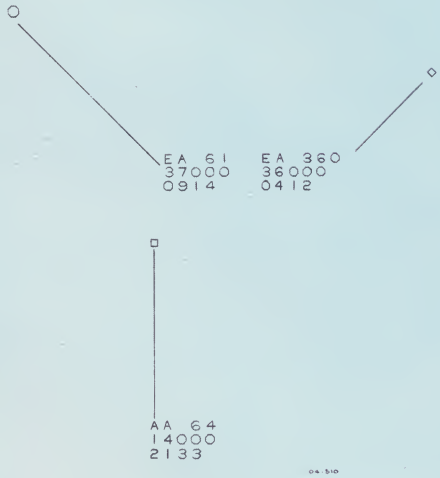

FIGURE 3
SAMPLE DISPLAY

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An example of an annotated radar display is shown in Figure 3.

ELECTRICAL SPECIFICATIONS

All digital input and output signal levels and impedances are compatible with conventional TTL integrated-circuit logic.

Inputs

Character and leader selection by 7-bit parallel words.

Character position: 4 bits X, 3 bits Y

Optional typewriter mode for sequencing of character positions.

Control pulses: Position Start, Write Start.

Outputs

Control pulses: Position Complete, Write Complete, Data Block Complete.

Leader and positioning deflection voltages: ±1.5 volts @ 20 ma. (Measured at the input to any display when terminated with 75 ohms).

Character deflection voltages: ±1.5 volts @ 20 ma.(Measured at the input to any display when terminated with 75 ohms).

Remote operation to 50 feet maximum

Character & Symbol Characteristics

Number of characters and symbols: 64, optionally expandable in increments of 64. Standard set per Figure 1. (Any other characters which are derivable using up to 20 strokes in a 4 x 8 matrix may be ordered optionally to replace any of the 64 standard characters.

Writing Time: 2.00 microseconds maximum, 100 nanoseconds minimum.

Average Character and symbol writing time: 1.35 microseconds or less.

Number of strokes: 20 maximum.

Character Size continuously variable in height from 0.6 volts to 1.5 volts (optionally from 0 to 2.0 volts).

Aspect ratio: 4 units high by 3 units wide. Others optional.

Uniformity: ±5% of character height.

Leader and Character Positioning Characteristics

Number of leaders: 32 as shown in Figure 2, Length and direction programmable by selection of printed circuit matrix card.

Writing time: 4.0 microseconds maximum for maximum length leader. Time for shorter leaders is dependent on length.

Hold time for end of leader position: 70 microseconds maximum to 2% of full scale.

Leader blanking for approximately 1/20 of longest leader length at beginning and end of each leader. (May be deleted on order).

Character positioning as programmed by an array of characters (8 x 16) whose individual locations are referred to the end of the leader.

Power Requirements

115 volts ±10%, 60 Hz ±3 cycles, 1.0 ampere.

MECHANICAL CONFIGURATION

19" relay rack drawer with slides using 7" of panel height and 25- 1/2" of depth.

ENVIRONMENT

Ambient temperature: 50° to 100°F.

Relative humidity: to 95% without condensation.

Other ranges on special order.

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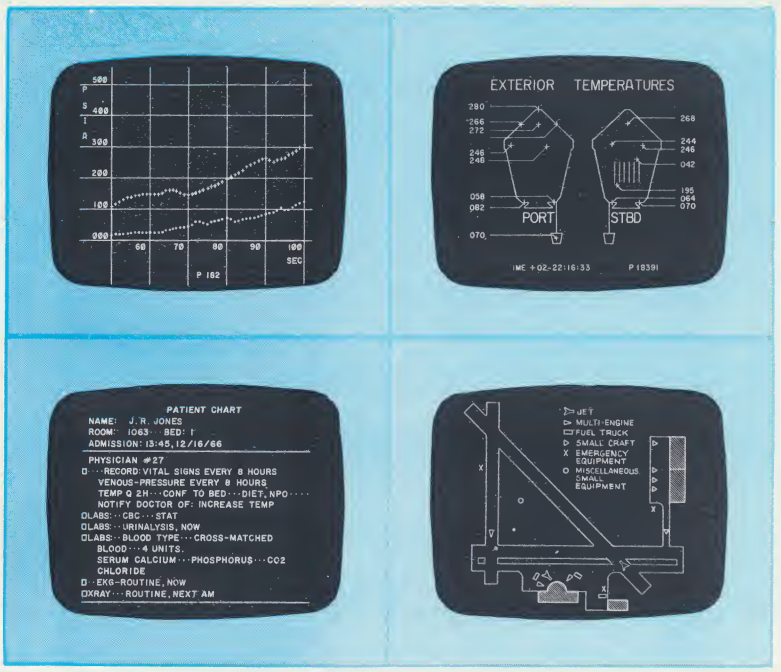


MONITOR 8300

Versatile

GRAPHIC DISPLAY PROCESSOR

for

Computer–Data TV (CDTV)

Display Systems

The MONITOR 8300 is a digital Graphic Display Processor which includes a built-in general-purpose computer for display generation and manipulation. It can stand alone or augment a computer facility. It offers both alphanumeric and graphic presentations at low cost per display channel. Associated data terminals utilize commercial TV monitors, optionally accompanied by manual input devices such as MONITOR 8540 Display Editors and light pens. System hardware options include such additional input and output devices as magnetic recorders, paper tape readers and punches, incremental plotters, printers and numerous other computer peripherals.

MONITOR is in a position to furnish low cost Computer-Data TV (CDTV) systems on a turn-key basis utilizing this low cost processor.

This form of display system, which uses standard commercial TV technology and equipment, offers the following advantages over the specialized direct writing systems:

RELIABILITY and ease of maintenance because of equipment simplicity.

ECONOMY, in particular where multiple display monitors are required.

BRIGHT, flicker-free stable images.

SUPERIMPOSED displays on broadcast or closed circuit TV pictures as backgrounds.

AUXILIARY EQUIPMENT readily available for video mixing, switching, recording, transmission, and monitoring.

Standard inputs are provided for operator-controlled keyboard units, ASR-33 teletype, and for a serial bit stream. Optionally, the 8300 may be provided with additional input interfaces for most digital computers and a variety of communications terminals. Up to 16 separate pictures synthesized by the system are available for presentation on an unlimited number of local or remote video monitors.

The self-contained general-purpose digital computer establishes control priority over input-output data transfers, generates characters and vectors, updates each of the refresh memory channels, and provides the user with an off-line computer facility. The unit is furnished with basic firmware. Special programs for display image manipulation and other purposes may be obtained on order.

The MONITOR 8300 is suited for applications which require sophisticated interaction between a multiplicity of operators and displays, but which require only medium-speed real-time updating of the displays. A companion system, the MONITOR 8500 (see separate bulletin) performs generally similar functions, but offers greater speed for specialized high-performance requirements, through use of special-purpose hardware rather than a general purpose computer.

FEATURES OF THE MONITOR 8300 are:

BASIC FIRMWARE furnished with each unit which minimizes date source software requirements by microprogramming.

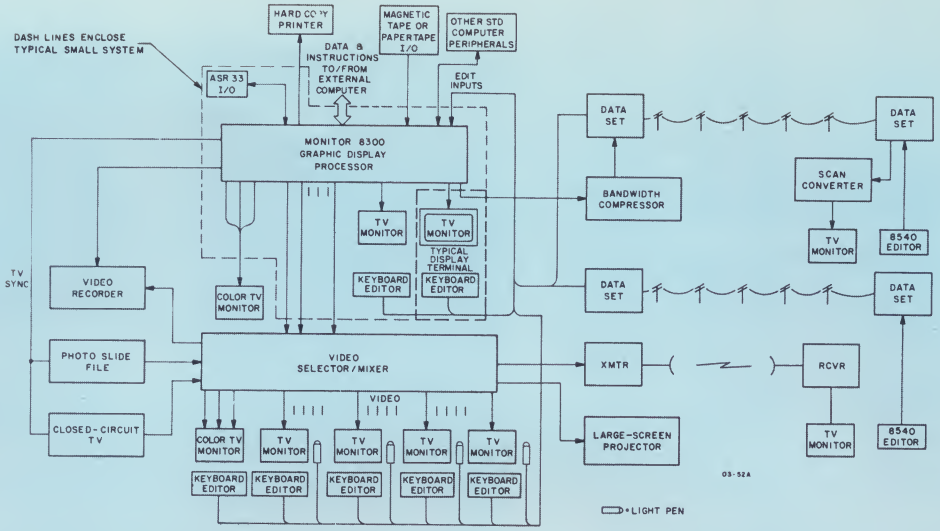
OPTIONAL MANIPULATIVE SOFTWARE for zoom, translation, and rotation of images.

MAN–MACHINE CONVERSATION by means of a keyboard for either direct or remote operation.

AUTOMATIC VECTOR GENERATION between specified end points.

REFRESH MEMORY using adjustment-free magnetic disc which stores and provides simultaneous outputs for up to 16 different TV display rasters.

CHANGE & UPDATE of TV raster images by firmware in response to computer-language inputs.



COMPUTER DATA TV SYSTEM

APPLICATIONS

The generalized system block diagram included above shows many typical system peripherals that could be included in the design of computer data TV systems (CDTV). The MONITOR 8300 is designed in such a manner that the customer may add peripherals, including data terminals as desired, thereby holding initial costs to a minimum based on immediate needs.

The unit will accept input instructions from a source computer or a multiple computer complex as well as from up to 16 remote keyboard units or light pens. An output of the processor will supply an input signal directly to a TV monitor. Through a commercial video selector/mixer the output may be applied to any number of TV monitors. It is possible, moreover, to apply TV signals from one or more other sources (such as the vidicon from an automatic slide file) to the selector/mixer. Common synchronization will then permit the overlay of characters or graphics on full gray-scale TV pictures.

The magnetic disc used for the refresh memories in the 8300 provides the normal TV sync source. An optionally available disc servo enables the system to be slaved to an external TV sync source. By deletion of the TV sync from the composite signal, any three video outputs may be programmed to correspond to the primary colors of a seven-color display and applied to the guns of a conventional shadow mask color CRT.

Typical applications which may require the sophistication available from the 8300 are:

Computer aided design.
Classroom and other educational applications.
Broadcast TV data presentation.
Process control.
Schedule posting.
Credit information.
Communications system monitoring.
Military and aerospace equipment checkout.

In all of these applications, the ability to alternate or superimpose data and ordinary closed-circuit TV pictures is an advantage to be exploited by the user.

Where permanent records of displays are needed, such as for evaluation of operator commands and reactions, conventional video tape recorders may be used. In such an example, a selected channel may be recorded continuously or a switching network may be employed so that a sample of every or any channel is recorded whenever a channel is updated. Hard copy printers are also available.

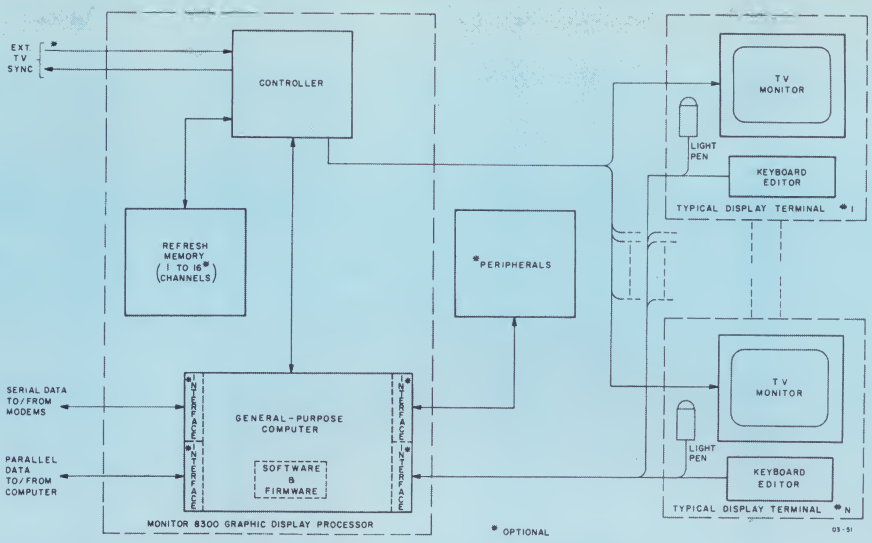
An optionally available TV multiplexer will permit two-way intercommunication on a single transmission line between a data terminal (where a TV display monitor might be located) and a remote source where the TV signal is generated. Such an arrangement will enable the TV monitor and a display editor, both located at the same remote point, to time share a single (normally coaxial) transmission line which furnishes the TV compatible information to the monitor.

FUNCTIONAL DESCRIPTION

The block diagram of the MONITOR 8300 shows the basic elements of the central display processor, and their relationship to individual data terminals communicating with the processor. The internal Computer may be equipped with a variety of optional interfaces. The Refresh Memory holds up to 16 display images in dot-sequential TV raster form. The Controller contains all logic and buffer circuits required for operation of system elements, including a TV sync generator and output buffers which convert parallel digital words to a serial video bit stream for each picture channel.

Instructions for channel selection, posting of new alphanumeric and graphic information, initialization of parameters, and other data is received either by direct wire from a keyboard, via a telephone communications terminal, or by direct interface with an external computer.

A portion of the internal computer memory is reserved for each input device to permit block input of source data. The size of the block is a function of the input device data rate and the number of operator terminals employed in the system. If the display processor is not required to update a refresh memory, operator inputs are processed on a first come – first served basis, with all unprocessed instructions in the associated



MONITOR 8300 SYSTEM

input data block being processed in one interval. When no operator inputs remain to be processed on an assigned priority basis, the system will accept data from an external computer source in a block transfer.

Within the internal computer is a reserved portion of memory which will have been programmed to contain character matrices for each of the characters in the repertoire. To permit discretionary programming of character sizes, intercharacter and interline spacing are stored in initializing registers. Stored character fonts and pitches are uniformly available to all display channels.

When the operator is updating an alphanumeric character display, average update time is one second, independent of the number of operators performing similar tasks. When an operator in a multi-access system is generating formats which include vectors, this posting time might be extended to as much as five seconds depending upon vector lengths. The display processor stores operator commands until the system updates the appropriate display. The operator, therefore, does not have to wait for the display to respond before continuing to add new elements.

During operation, input instructions which specify characters are interpreted by table lookup control programs and directed to a character generation subroutine in the processor. In the random mode, character position in the display raster is specified by the instructions. In the sequential character mode, position is automatically referenced to that of the previous character, using the previously established character and line pitches.

A subroutine is also included which permits vectors to be generated by specifying the end points. Vectors are generated 32 TV lines at a time and posted to the Refresh Memory.

A reserved portion of the internal computer memory stores the display image for the current channel being processed in digital form. The contents of this memory represent a portion of a bit-for-dot matrix of the TV output presentation, where each line on the TV display is composed of closely spaced bright or dark spots. By performing a sequence of instructions involving the character and vector subroutines, a dot matrix graphic image is synthesized step-by-step and stored in this portion of memory. Similarly, an image already in this memory may be updated by additions and/or deletions.

When update or modification of this reserved portion of memory is complete, all computer processing halts and the contents of the reserved portion of memory are read into the proper segment of the refresh disc memory. The selected channel is posted by transfer of the contents of the magnetic disc, with gaps inserted to provide for horizontal and vertical blanking during the continuous real time conversion of the channel output to TV video. The readout sequence is compatible with the TV requirement for two interlaced fields per frame. Each of the two fields to be interlaced occupies a 180° sector on the disc, which rotates at thirty revolutions a second. During every disc revolution, a complete TV frame is scanned.

To obtain the required 8 million bit per second video output rate, each refresh memory channel occupies a set of disc tracks. Each successive multiple-bit word is read out from its respective track set, and then converted by an output buffer to that portion of the bit stream representing the video data of the TV output. Sync signals are mixed with the data bit stream to provide a composite video output meeting the standards of the Electronic Industry Association (EIA) for television signals.

When an image which is stored in a refresh memory channel is to be modified, the contents of the proper segment of the channel are transferred nondestructively to the reserved portion of the internal computer memory. Additions or deletions are made as commanded by the incoming instructions from a remote data source or a display editor. After the last instruction is processed in an appropriate sequence relating to that channel, the contents in the reserved portion of the processor memory are transferred back to the refresh memory channel where replacement of the previous contents occurs by overwriting.

When peripheral television equipment is incorporated into a system, it may be slaved to the internal TV sync signals of the MONITOR 8300. If this mode is not feasible, an optional servo drive may be specified so that the refresh memory disc of the 8300 may be slaved to an externally generated signal.

SPECIFICATIONS

Instructions From Display Terminals:– Operator inputs from up to 16 keyboard units are received by the display processor. Operator actions are coded to identify characters, vector start and stop, and control operations including cursor movement.

Instructions Via Communications Link:– One serial input from modem standard, up to 15 additional optional.

Instructions From Computer:– Direct wire interfaces to order, either parallel or 8-bit byte transfer. Asynchronous input up to 250,000 instructions per second with request-acknowledge control.

Instructions From ASR-33:– Standard system includes teletype interface for program inputs and debugging. ASR-33 optional.

TV Sync:– Horizontal sync, vertical sync, composite blanking and composite sync available on separate 75 ohm coax for use by external system elements. Optional provisions for slaving to external sync source.

Display Format:– Resolution approximately 1 part in 480 both horizontally and vertically. Aspect ratio 4 horizontal to 3 vertical. A 5 x 7 character font will provide a maximum of 2,304 characters per page (48 characters per line, 48 lines). Vectors are generated by using the best straight line approximation between any two points. Any complex line drawing can be generated by piece-wise approximation.

Character Repertoire:– 63 characters per set; one set standard, additional sets optional. Code as ordered (ASCII, IBM, EBCDIC).

Character Size:– Each character programmable to any size within a 16 x 24 dot matrix. (Other maximum matrix dimensions on special order). On a 19-inch 525-line monitor, a 16 x 24 bit character is 3/8" x 1/2".

Vectors:– Automatically synthesized between program-specified end points. Cursor may be used by operator to locate these end points in manual image synthesis.

Cursor:– Short horizontal line usable as a position reference. May be slewed by an operator. Automatically denotes next character location in "typewriter" mode.

Software & Firmware:–

Display routines:

- System control executive
- Priority interrupt
- Character generation
- Random character positioning
- Vector positioning and generation
- Edit
- Sequential character positioning
- Vector generation
- Diagnostics
- Optional peripheral I/O.

Optional manipulative routines:

- Light pen
- Translation
- Rotation
- Sealing
- Zoom about cursor.

Technology:– High reliability integrated circuits.

Power Inputs:– 115 volts, 60 Hz, 20 amperes.

Environment:– Ambient temperature 50°F to 100°F. Relative humidity to 95% without condensation. Other ranges on special order. Self ventilating.

Size:– 70" high x 24" wide x 32" deep cabinet includes space for options. ASR-33 on separate stand. No special installation requirements.

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MONITOR SYSTEMS
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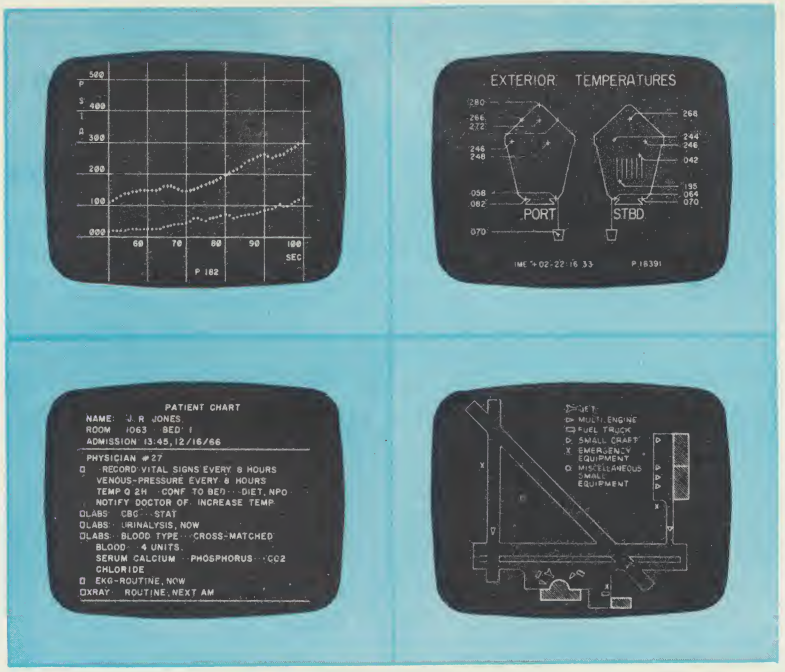
MONITOR 8500

high performance DIGITAL DISPLAY GENERATOR for Computer-Data TV (CDTV) Display Systems



The MONITOR 8500 Digital Display Generator interprets computer-generated digital data and presents it in graphic and alphanumeric form on standard commercial television monitors. Input interface options provide for easy direct connection to most digital computers, and to a variety of communications terminals. Up to 20 independent synchronous video outputs provide simultaneous separate images to refresh local or remote TV displays. The number of different images and formats from which each of these outputs may be selected is limited only by the memory capacity and software of the source computer. Model 8540 Display Editors, described in a separate brochure, provide keyboards and operator controls to permit display-format selection and content editing either directly by wired connection or via communication line, or indirectly through the computer.

On a turnkey basis, MONITOR offers powerful new Computer-Data TV (CDTV) systems employing these units in combination with standard TV hardware and with computer software as required for each application.

Presentation of data in flicker-free commercial standard TV form offers advantages not available with stroke-writing or direct-beam-positioning CRT displays:

INEXPENSIVE MONITORS for multi-station applications.

SUPERPOSITION of computer-originated data and graphics on full-gray-scale TV pictures from closed-circuit TV or a vidicon-equipped automatic slide file.

STANDARD TV EQUIPMENT availability for video transmission, switching, mixing, and recording.

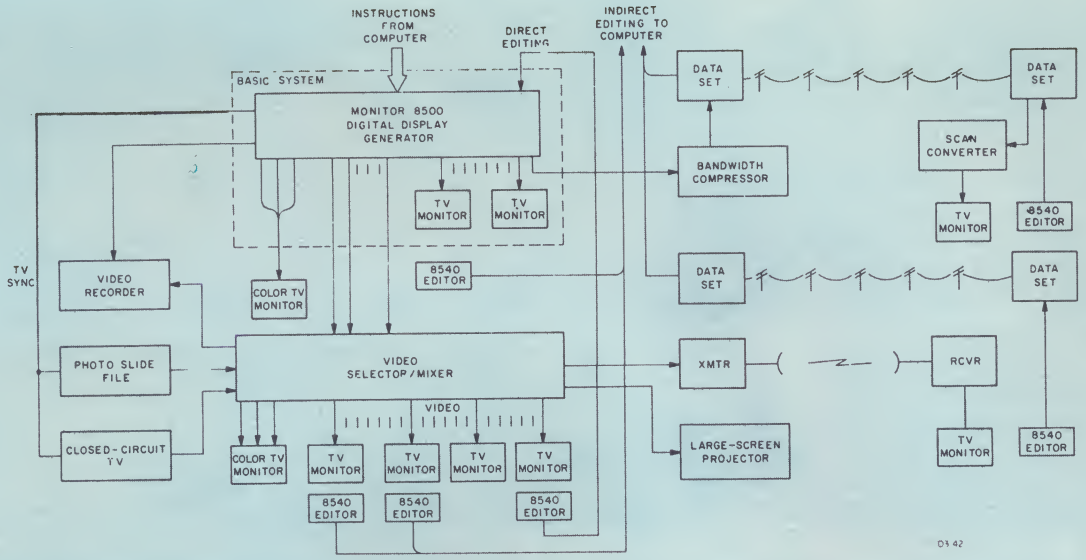
HIGH-SPEED UPDATING of images on remote monitors through use of video link.

COLOR display generation by assignment of one video output to each of the three guns of a standard shadow-mask tube in a conventional color TV monitor.

Low-cost medium-speed Graphic Display Processors are availin MONITOR's 8300 units, each of which includes its own general-purpose computer. See separate bulletin.

Outstanding features of the MONITOR 8500 are:

- Hardware capabilities which minimize computer software requirements.
- Man-machine conversation using companion MONITOR 8540 Display Editor by either direct connection or voice-grade communication link.
- Optional input buffer which permits asynchronous block transfer and minimizes housekeeping in transfer of data from the computer.
- Programmed initialization of
  —character fonts
  —space between characters and lines in "typewriter" mode.
- Synthesis and alteration of TV-raster images from computer-language instructions.
- Automatic generation of vectors between input-specified end points.
- Adjustment-free magnetic- disc Refresh Memory for storage and simultaneous output of up to 20 different display pictures in TV form.
- Quick replacement of images stored in the Refresh Memory by others through rapid processing of computer inputs.
- All-digital integrated-circuit technology.



COMPUTER DATA TV SYSTEM

APPLICATIONS

The generalized block diagram above suggests the variety of unusually high performance display systems which can be built around the MONITOR 8500. Because of the number and variety of options and peripherals available, wide ranges of performance and price are spanned. An installed system can be augmented as requirements expand.

The MONITOR 8500 accepts input instructions from a computer or a multi-computer complex, and from one or many MONITOR 8540 Display Editors. The standard TV output signals can be fed directly to TV monitors, or can can be applied to a Video Selector/Mixer for distribution to a set of monitors.

TV signals from one or more local or remote TV cameras, e.g. the vidicon from an automatic photographic-slide file, may also be applied to this Selector/Mixer matrix. If the full-gray-scale pictures from such sources are to be superimposed on black-and-white display images synthesized in the 8500, common synchronization is employed. The magnetic disc used for the Refresh Memories in the 8500 is normally the prime source of TV sync. The use of an optional disc servo permits the 8500 to be slaved to an external TV sync source.

With optional deletion of TV sync from the composite signal, any three video outputs may be programmed to correspond to the primary colors for a seven-color display, and applied to the guns of a conventional shadow-mask color CRT.

A TV monitor may be used for display only, or may become part of a man-machine link when it is accompanied by a MONITOR 8540 Display Editor. An 8540 can be connected directly to the 8500 Digital Display Generator, or can provide inputs indirectly by way of the computer so that operator commands can be coordinated with computer programs. Alternatively, an 8540 can be equipped with an interface which permits connection to a data set for transmission to the computer over a voice-grade link. This connection is required where the Display Editor is remotely located, as when a monitor is fed via a long-distance video transmission link, or via a telephone type channel through use of a scan-conversion unit.

Where permanent records of displays are required, for purposes such as after-the-fact evaluation of operator decisions and reactions, conventional magnetic-tape video recorders can be employed. A selected channel may be recorded continuously, or a switching network can be used in such a way that a snapshot of every channel is recorded whenever a channel is updated.

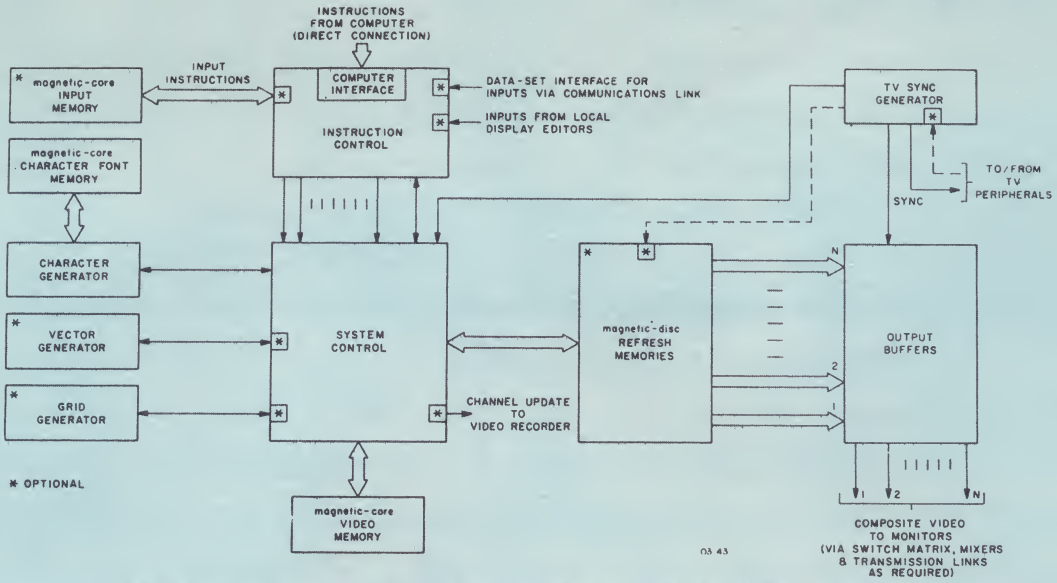
FUNCTIONAL DESCRIPTION

As depicted in the block diagram of the MONITOR 8500, instructions for channel selection, posting of new alphanumeric and graphic information, and initializing are received via a computer interface in Instruction Control. Instructions may also be received from direct-connected MONITOR 8540 Display Editors. Alternatively, inputs from both computer and Display Editors can be from a remote location via common-carrier communication links.

Optionally, an Input Memory is available as a first-in, first out buffer which permits block transfers from the computer. Decoded commands derived from the input instructions are applied to System Control, where all operations are supervised.

Initially, dot matrices for each of the characters in the programmed repertoire are stored in the magnetic-core Character Font Memory. To permit discretionary programming of character sizes, inter-character and inter-line spacings are also stored in initializing registers. These character fonts and pitches are uniformly available to all display channels.

During operation, input instructions which specify characters are interpreted by Instruction Control and applied to the Character Generator, which controls the non-destructive readout of the proper character matrix from the Character Font Memory and its storage at appropriate coordinates in the Video Memory. In the random mode, character position in the display raster is specified by the instruction. In the



MONITOR 8500 - DIGITAL DISPLAY GENERATOR

sequential character mode, position is automatically referred to that of the previous character, using the pre-stored character and line pitches.

The optional Vector Generator responds to instructions which specify the locations of the two ends of a vector. The set of dot positions representing the best approximation to a straight line between the end points is generated automatically and stored in the Video Memory.

The optional Grid Generator uses stored horizontal and vertical line pitches and boundaries to control the operation of counters and logic which generate a set of grid lines usable for point-plot graphical presentations where relief of software burdens in this area may be especially desired. Alternatively, grid lines may be programmed as vectors through use of the Vector Generator.

The magnetic-core Video Memory stores in digital form the display image for the channel currently being processed. The contents of this memory represent a bit-for-dot map of the TV output presentation, where each line on the TV display is composed of closely spaced bright or dark spots. By performance of a sequence of instructions involving the Character, Vector, and/or Grid Generators, a dot-matrix graphic image is synthesized step-by-step and stored in the Video Memory, or an image already in the Video Memory is updated by additions and/or deletions.

For a single-channel system, the contents of the Video Memory are scanned out continuously in proper sequence for conversion to a video bit stream. If more than one display image is to be available for viewing at a given time, a multi-track magnetic disc is used to supply the desired number of channels of Refresh Memory. The selected channel is posted by transfer of the entire contents of the Memory disc, with gaps inserted to provide for horizontal and vertical blanking during the continuous real-time conversion of the channel output to TV video. The readout sequence is compatible with the TV requirement for two interlaced fields per frame. Each of the two fields to be interlaced occupies a 180^{o} sector on the disc, which rotates at 30 revolutions per second. During every disc revolution, a complete TV frame is scanned.

So that the required 20-million-bit-per-second video output rate is achieved, each Refresh Memory channel occupies a set of disc tracks. As each successive multi-bit word is read out from this set of tracks, it is converted by an Output Buffer to a portion of the bit stream representing the video data in the TV output. Synchronization from the TV Sync Generator is mixed with this data bit stream to provide composite video output which meets Electronic Industries Association (EIA) standards for television signals.

When the image stored in a Refresh Memory channel is to be modified, the contents of that channel are read (non-destructively) to the Video Memory. Additions or deletions are made as called for by the incoming instructions from the computer or a Display Editor. After the last instruction is processed in a sequence relating to that channel, the Video Memory contents are transferred to the Refresh Memory channel where they replace the previous contents by over-writing.

Where peripheral television equipment may be involved in a system, it may be slaved to the synchronizing signals from the MONITOR 8500. If this mode is not feasible, the optional servo drive may be employed for the Refresh Memory disc, so that the 8500 may be slaved to external sync.

INSTRUCTION REPERTOIRE

LOAD CHARACTERS (Initialize) (LCI). Provides for acceptance of block transfer of 60 x 24 = 1440 successive 16-bit computer words representing 60 characters, each a 24 x 16 dot matrix (optionally 24 x 32) or special size.

LOAD PITCH (Initialize) (LPI). Specifies inter-character and inter-linear pitch for sequential-character "typewriter" operation. Permits adaptation to actual programmed size and aspect ratio of characters.

CHANNEL SELECT (CHS). Causes non-destructive transfer of selected Refresh Memory channel to Video Memory for updating by subsequent instructions.

UPDATE COMPLETE (UDC). Causes replacement of previously selected Refresh Memory channel by updated contents of Video Memory.

CLEAR VIDEO MEMORY (CVM). Clears Video Memory in preparation for synthesis of new display image as opposed to updating of an image stored in the Refresh Memory (see CHS).

CHARACTER, RANDOM POSITION (CRP). Identifies selected character, non-destructively reads pre-stored dot matrix from Character Font Memory and transfers it to Video Memory register at locations corresponding to the stated X-Y position in the display image. The transferred dot matrix may either overwrite existing data or replace it (blank character causes erasure). Boundaries of the locations replaced are defined by the prestored pitch values.

CHARACTER, SEQUENTIAL POSITION (CSP). Like CRP except that locations in the Video Memory are established automatically by "typewriter" logic.

CURSOR ON (CON). Specifies a channel and enables a cursor (short horizontal line) on that channel to provide operator(s) with position reference for input and editing with the MONITOR 8540.

VECTOR START (VST). Establishes starting coordinate of a vector.

VECTOR STOP (VSP). Establishes ending coordinates of a vector, initiates synthesis of best straight line to this point from previously specified Vector Start location (see VST) and stores dots in corresponding Video Memory locations.

SPECIFICATIONS

INSTRUCTIONS FROM COMPUTER:
16-bit parallel data transfer. Request-acknowledge control. Levels 0 and +5 volts. 8-bit byte inputs optional. Asynchronous transfer at rates to 500 K instr./sec.

INSTRUCTIONS FROM DISPLAY EDITORS:
Optionally, inputs from one to four MONITOR 8540 Display Editors (see separate brochure) can be received directly by hard wiring or from remote locations via common-carrier communication links. (Normal Editor input is indirect, through computer, permitting computer control of queing and retention of edit instructions for subsequent use.)

TV SIGNALS:
Up to 20, as ordered, simultaneously available EIA RS-170 525-line standard composite video signals. Each output on separate 75-ohm coax. Additional groups of 20 optional. 512 elements/line.
Optionally 729, 945, 1029, or 1125 line TV.

TV MONITORS:
Number, size, and connections as required by order.

TV SYNC:
Horizontal sync, vertical sync, composite blanking, and composite sync available on separate 75-ohm coax for use by external CDTV system elements. Optionally, the 8500 may be slaved to an external TV sync.

CHARACTER REPERTOIRE:
60 characters per set; one set standard, additional sets optional. Code as ordered (ASCII, IBM, EBCDIC).

CHARACTER SIZE:
Each character can be programmed to be any size within a 16 x 24 (optionally 32 x 24) dot matrix. Aspect ratio multiplier 1.3 x 1. (Other maximum matrix dimensions on special order). On a 19" tube 525-line monitor, a 16 x 24 bit character is 3/8" x 1/2".

VECTORS:
Automatically synthesized between program-specified end points using optional Vector Generator.

GRIDS:
Specifications for Optional Grid Generator available.

CURSOR:
Short horizontal line usable as position reference. May be slewed by operator. Automatically denotes next character locations in "typewriter" mode.

DISPLAY PROCESSING TIME:
Approximately 0.1 second for processing of the complete dating of a typical display image, including Refresh Memory transfers. No interruption of TV Channel output occurs during this time. Changeover to new image occurs abruptly.

TECHNOLOGY:
High-reliability integrated circuits on field-proven logic cards. Sliding drawers permit front access. See separate brochure on MONILOGIC.

POWER INPUT:
Commercial mains; nominal 115 volts, 60 Hz, less than 30 amperes.

ENVIRONMENT:
Ambient temperature 50°F to 100°F. Relative humidity to 95%, without condensation. Other ranges on special order.

COOLING:
From sub-floor ducts; optionally, with integral blowers.

SIZE:
52" wide x 72" high x 32" deep with all options, for 20 channels of 525-line TV. 1200 lbs. approximately.

MONITOR SYSTEMS
an AYDIN company

DATA TERMINALS
DISPLAY PRODUCTS
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